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CHOLERA

WHAT IT IS,

AND

HOW TO PREVENT IT.

BY

EDWIN LANKESTER,

M.D., F.R.S.

Medical Officer of Health, St. James's District.

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MEMBER OF THE ROYAL COLLEGE OF PHYSICIANS, LONDON; MEDICAL OFFICER OF HEALTH OF ST. JAMES'S, WESTMINSTER.

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NOTICE.

THE following remarks were written at the request of the publishers, and were undertaken by the author, in the hope, that they may serve in some measure to instruct those who may read them, in the causes and means of preventing the terrible disease with which the country is at present threatened.

23, *Great Marlborough Street.*
August 22, 1866.

CHAPTER I.

HISTORY OF CHOLERA.

THERE are few epidemic diseases which have excited more alarm and given rise to greater apprehensions than the disease known popularly as Cholera. Although this name, for a certain form of disease, has been familiarly known to medical men from the time of the Greek and Roman writers on medicine, it has only been within the last fifty years that it has gained a special significance, and has been associated with the word Asiatic, to indicate more especially its origin on the continent of Asia. Previous to its outbreak in Hindostan, in 1817, the disease known by the name of cholera had never been seen as an epidemic disease in Europe, and certainly had never been regarded as contagious. In the autumn of the year in most countries of Europe, and also in Great Britain, the disease called cholera was familiar, and medical writers called it *Cholera Morbus*. This disease was attended with the symptoms of purging and

vomiting, and seemed to be an exaggeration of the state of system in which diarrhœa usually comes on. It was frequently fatal, and more prevalent in some places than in others.

It was between the years 1817 and 1830 that accounts were brought from our possessions in the East Indies that created alarm, lest the disease, which had devastated Hindostan, should by any means be conveyed to this country. The history of its outbreaks and the facts of its propagation showed that it might be conveyed in any direction along the lines of human intercourse.

The first accounts we heard of the disease were from places situated on the delta of the Ganges, where it appeared at the end of May or the beginning of June, 1817. From this spot, in the years 1818-19, it extended itself through the whole of the Indian peninsula. In 1820 it found its way to China, and in the following year ravaged the populous islands of the Indian Archipelago. In the same year it appeared on the shores of the Persian Gulf, spreading to parts of Arabia, Syria, and Persia, thus threatening Europe. In 1823 it was first seen in Russian territory, in Tiflis, Orenberg, and *Astracan. Here* the disease seemed for a time *have been* arrested, but it again broke out

in Orenberg in 1828, and in 1830 advanced to the southern frontiers of the Russian empire, in which year Moscow was attacked. In March, 1831, the disease was at Warsaw, in May it appeared at Dantzig, and in Sunderland in October of the same year. In the following year it broke out in Paris and in London. In all these places the disease appeared suddenly, and spread with irresistible force, speedily attaining its maximum of mortality, and then as suddenly retiring. After this first outbreak of the disease in Europe it again disappeared, but another outbreak was again reported in India, which, travelling in almost the same route, appeared in Europe in the years 1847-48, and 49. Again London and many of the great towns of England were attacked, and again became free from the disease. A third visitation occurred in the years 1852-3-4. London was visited in the latter year, and although the mortality was not so large as in the previous attacks, the disease appeared to have lost none of its virulence, and the number which died, in proportion to those attacked, was about the same.

In 1864 this disease was again announced as invading Europe, and, in this instance, the line of its advance was somewhat different. We *were first* alarmed by the approach of cholera,

for the fourth time, by reports of its appearance in Egypt, more especially along the march of the army of pilgrims from Mecca. The disease was clearly not generated at Mecca, but brought there by Mohammedan pilgrims from the East.* From Mecca it was brought by the returning pilgrims to Alexandria, and thence along the ports of the Mediterranean to Southern Europe. The localities of the first attacks in England were somewhat different. In previous attacks it had first appeared in the north. This time we heard of it first in the south. It first appeared at Southampton on the 10th of July, and subsequently was reported at Weymouth, Portland, and Dorchester. One of the most singular episodes in the history of the arrival of cholera in England in 1865, was its appearance in a small village named Theyden-Bois, near Epping. Here lived a farmer who, with his wife, went to spend a fortnight at Weymouth in September last. On returning home he was seized with diarrhœa. He, however, arrived at home on the 26th of September. His wife, after getting home, was attacked with the same complaint, and died on the 11th of October, with all the symptoms of cholera.

* *"Cholera Prospects."* By Tilbury Fox, M.D. *London: Hardwicke.*

Subsequently the farmer himself died, and of eleven members of his family attacked, eight died. It was found in this case, that all the drinking water of the household came from a well into which the soakings of the water-closet continually flowed. The conclusion arrived at in this case was that the farmer had contracted the disease in the south of England, and poisoned the well from which his family partook their drinking water. A curious point in connexion with this case has been pointed out, and that is, that the sewage of this house flowed into the river Coffin, a little stream which empties into the river Lea.*

As to how the outbreak occurred at Southampton there can be little doubt, as several vessels had arrived there from the Mediterranean with cholera on board. In the same manner cholera appeared on board emigrant ships coming from Holland with German emigrants on board. Cholera having prevailed extensively in Rotterdam and other cities on the Continent during the summer of 1865, explains the cause of the outbreak in these ships.

These, then, were the principal indications that we had in 1865 that we might apprehend

* "Eighth Report of the Medical Officer of the Privy Council, with Appendix." 1860.

an outbreak of cholera in London, Southampton, or Liverpool in 1866. In June of this year it was announced that cholera cases had occurred again in Southampton and Liverpool, whilst a larger amount of diarrhœa than usual occurred in London. It was not, however, till the 2nd of July that the mortality assumed a serious aspect; it was then found from the weekly return of the Registrar-General that the deaths which were 1292 on the 7th of July were 1540 on the 14th, 1798 on the 21st, and 2600 on the 28th of July.

The mortality of London was doubled by this explosion of cholera, and the greatest anxiety prevailed lest the disease which had so suddenly broke out should extend in all directions. It was soon, however, found that the attack was confined to the east end of London. It was further observed that the cases principally occurred in those districts of London comprising Whitechapel, Bethnal Green, Bow, and Poplar, supplied with water by the river Lea. It was also found that this district was the only one in London to which the great main drainage works now being completed had not extended. On these grounds a hope was expressed that the disease might not extend to other parts of *London. But should* this hope lead to care-

lessness on the part of individuals, and neglect on the part of public authorities, a single case imported from the infected district may be the means of a similar explosion in any other part of London. It is with the object of preparing the public to understand the nature of this terrible pestilence, and to put them in a position to resist its influence, and prevent its spread, that these pages are written. It is not by keeping the public in ignorance of the nature of this disease that any good can be done; but it is by imparting an intelligent apprehension of the great natural laws involved in the course and progress of this disease that we may hope to deprive it of its fatality, and even convert its awful presence into a future blessing.

CHAPTER II.

IS CHOLERA CONTAGIOUS?

AFTER the previous history, it would appear to some people almost superfluous to ask this question. A disease which is traced from a central locality, which has constantly been carried from that spot by human intercourse, that is never known to spring up spontaneously, but always to travel through the agency of infected persons, bears all the character of a contagious disease, and the facts will hardly bear interpretation in any other way. Nevertheless, great doubts have been thrown upon the theory of its contagiousness. Many of the governments of Europe have treated it at times as non-contagious, and none more obviously than our own, and there are many distinguished medical men even at the present time who maintain that the disease is not contagious. Unlooked for as it might be, there is evidence to show that the maintenance of these opposite opinions about the contagiousness of cer*tain diseases is not* altogether unconnected

with political views. Thus during the early part of this century the free-trade party were most earnest in their efforts to induce the governments of Europe to abandon the quarantine of vessels proceeding from infected ports. In order to gain this end they endeavoured to show that the plague and other diseases for which quarantine had been established were not contagious. This party foresaw that the arrival of cholera would be the signal for securing obstructive quarantine regulations, and some of their leading men were distinguished for their maintenance of the theory of the non-contagiousness of cholera. Our government has always more or less leaned to this theory, and the most distinguished members of its sanitary boards have been non-contagionists. It ought, however, to be known that several of the scientific and medical gentlemen employed by the government have from time to time given in their adherence to the theory of contagion, and the recent reports of government agents confirm this theory, and the late regulations issued by the Privy Council* recognise to its fullest possible extent the theory that cholera owes its origin and extension to *a poison secreted in the mucous membrane of the alimentary canal.*

* "Orders of Privy Council in relation to Cholera." *1866.*

If cholera is not produced by contagion, the question comes as to what are its originating causes. Now, we are not without evidence to show that certain diseases arise and spread quite independent of any poison propagated within the human body. Thus we are familiar with a disease in England known by the name of "ague," which evidently originates in a poison which is generated outside the human body. This poison, which without having been examined or even seen, we call malaria, is generated by decomposing vegetable matter. We know the districts where it prevails—we know where it will prevail most, and we can at will remove the cause. In the same way the simple diarrhœa of this country occurs at a certain season of the year, it arises from definite causes; and here there is no specific poison or contagion passing from one body to another, and maintaining and spreading the disease. Reasoning from analogy there is no doubt that those who advocate the non-contagiousness of cholera should point to our summer diarrhœa as the type of the more fatal disease, and that cholera is only, as it were, an intensification of diarrhœa by certain meteorological conditions acting upon systems made susceptible by the unsanitary circumstances in which they have lived. Now these two points have been *most carefully* examined. During the epidemics

of 1848 and 1854 careful observations were made in London of the state of the atmosphere; but although every condition was investigated with great laboriousness, no special conditions could be discovered which were connected with outbreaks of cholera. The disease has sometimes prevailed in mid-winter, whilst undoubtedly its attacks are more frequent in hot summer; but heat cannot be regarded as a cause. Humid atmospheres and climates seem to favour its attacks; but the cause of cholera has never been traced in any districts to humidity. It is the same with other conditions of the air, its electricity, the presence of ozone, its density and elasticity have been all carefully examined, but no one of them, by their constant presence or absence, could for a moment be regarded as the cause of cholera. So recently as the outbreak of the cholera at Southampton in 1865, the attack was investigated in reference to the meteorological conditions in that town; and this was done with the ample resources of the Meteorological Apparatus of the Ordnance Survey Office in that town.* Careful observations made during the months of August and September showed that during the first month there was no unusual me-

* See Dr. Parkes' Report in "Eighth Report of the Medical Officer of Privy Council."

teorological condition except an excess of rain, and in the last month an excess of heat and no rain. The experience in other parts of the world has been the same: there is no condition of atmosphere and season that can be laid hold of as the cause of cholera. There is one other point connected with the state of the air which was investigated at Southampton, and that is, the question of the possibility of the cholera miasm having been brought from a distance by prevailing winds. It was found that both before and during the prevalence of cholera the wind was blowing in all directions, and there was not the slightest evidence to show that any foreign or poisonous matter had been conveyed to the town by that agency.

The second point on which the non-contagionists lay great stress is the occurrence of cholera in districts where unfavourable local conditions exist. There is no doubt that cholera is most virulent and fatal in those towns and districts of towns where dirt and filth, and poverty and neglect of sanitary laws prevail. But we have yet to receive the facts on which the theory can be established that cholera is produced by any combination of organic and inorganic matters independent of a special poison. There is *nothing more striking* in the history of cholera *outbreaks than to find* it passing over houses, dis-

tricts, and towns remarkable for their deficient sanitary arrangements and general insalubrity, and fixing itself in localities where sanitary agencies have been comparatively active. Upon the dirt and filth theory, how could we account for the outbreak at Southampton? It was not in the dirtiest parts of Southampton and its neighbourhood that it occurred at all, but here and there in isolated spots; and to nearly all these spots the cholera was traced from on board the ships which had arrived from the Mediterranean with cholera on board.

It has been by the entire failure of any other theory to account for the spread of cholera that inquirers have been driven to accept the theory that the disease is contagious, and that it is only propagated by a poison which being generated in one body is communicated to another. If there were only a probability of this being the true state of things, it is of the utmost importance in all attempts to prevent the spread of the disease that this should be recognised, and that our efforts should be directed to the covering of both issues. All who have anything to do with cholera should act as though it were the most contagious of diseases, and not neglect the removal of dirt and filth, as though they *were the real* producers of the calamity.

CHAPTER III.

SYMPTOMS OF CHOLERA.

THE duration of an attack of cholera varies from two or three hours to several days. Medical men recognise three stages:—1. A premonitory stage. 2. The stage of collapse. 3. The febrile or reactionary stage.

The premonitory stage is that in which the symptoms are those of ordinary diarrhœa. There is looseness of the bowels, with or without pain. In this stage cholera is not to be distinguished from ordinary diarrhœa. It is, however, of the utmost importance when cholera is prevailing that no case of diarrhœa should be treated as merely an ordinary case of that disease, as all experience shows that where this premonitory diarrhœa is early attacked it may be arrested and the more formidable symptoms of cholera prevented. At the same time there are, no doubt, *cases in* which these preliminary symptoms *suddenly pass into* the subsequent stages, and

forbid anything like treatment that would lead to the arrest of the disease.

The second or cold stage of collapse is characterized by both purging and vomiting. The stools consist of a watery, colourless fluid, without smell, and having the appearance of barley or *rice water*. In this fluid are observed flakes of an albuminous character floating about. Whilst these discharges are very frequent, the patient complains of severe cramps, especially in the legs. These symptoms are accompanied with great exhaustion, giddiness, and general weakness. The pulse becomes small, frequent, and accelerated, and as the disease advances, almost imperceptible. The skin becomes cold and is covered with a profuse sweat or a clammy moisture. The temperature of the whole body is perceptibly lower. A thermometer placed under the tongue will indicate a temperature much below the natural heat of the body. There is great restlessness; the patient, though so cold, complains of heat and throws off the bedclothes. There is great thirst and pain at the pit of the stomach, and the respirations are much more frequent than usual. The features are shrunk and anxious, the eyes are dull and suffused, the tongue is moist but cold, the voice is feeble, hollow, and hoarse, and very charac-

teristic of the disease. As the disease advances the skin is not only cold but blue. Hence the names Algide Cholera and Blue Cholera which have been applied to this disease. The functions of the brain remain unimpaired to the last. As the disease advances the urine becomes suppressed, the pulse becomes smaller, and the patient dies of exhaustion. Death sometimes comes on very rapidly in this stage without all the symptoms being developed. In other cases all these symptoms continue for many hours or even days, and eventually the third stage, that of *consecutive or reactionary fever* sets in.

In this stage the coldness and blueness of the skin gradually disappear, the pulse acquires increasing force, the face becomes flushed, the vomiting is less frequent, the diarrhœa continues. The urine is secreted again, and other favourable symptoms are observed. Although this stage is indicative of an ability on the part of the patient to resist the disease, he not unfrequently succumbs, and dies from exhaustion some days, or even weeks, after his first attack.

As the object of these pages is not the instruction of the medical student, we shall not pursue the question of the symptoms of this disease any further, nor shall we enter into the *question of the* causes of the symptoms which

are presented in its course. Melancholy as is the duty of watching by the bedside of the suffering, and painful as the attendance upon the sick who cannot be rescued from their fate may be, there is after all a profound interest awakened in the inquiring mind as to the nature of that poison which invisibly introduced into the system of the living man so soon acts upon every organ, and in so many instances destroys the fabric of the most perfect organism in the course of a few hours. The havoc of the tornado in a tropical forest gives but a faint image of the effects of this poison when once it has gained access to the wonderful mechanism of the human frame.

The intense interest excited in the mind of the scientific inquirer, is the guarantee that as long as this disease shall be a scourge to mankind, so long will there be intense minute and anxious research into the nature of that chain of causes which results in the wonderful and disastrous effects of this disease upon the human body.

CHAPTER IV.

THE POISON OF CHOLERA.

ALL contagious diseases are the result of three great factors, the absence of any one of which must prevent an epidemic.

There must be first a *special* poison; second, a person *predisposed* to take that poison; and third, a *medium* conveying the poison to the predisposed individual. In other words there must be a poison-maker, a poison-taker, and a poison-bearer. Unless these three things are present there will be no spread of contagious disease, and I may illustrate this position by what takes place in a disease which is universally admitted to be contagious, I mean small-pox. In order to propagate this disease there must be, first, the poison-matter from a small-pox pustule; secondly, a person predisposed to take the disease; and thirdly, a medium for the conveyance of the poison, either the point of a lancet inserted into the flesh, or an atmosphere to convey the poisonous germ. If

the poison is not there no amount of predisposition will serve to engender the disease. Again, if the poison be there and the predisposed person—unless some medium is present, unless the poison is conveyed to the predisposed person, there will be no production of the disease. A person predisposed to take the small-pox may stand by the bedside of one who has the disease, but if the current of air blows away from the predisposed person, the poison will not come near him, and he will escape; or the atmosphere in which both are placed may be so extensive, that the poison being diluted will not act upon the predisposed individual. But let the poison be ever so intense, and the medium ever so ready to convey it, if the unaffected individual has been vaccinated, he is not predisposed to take small-pox, and he will not contract the disease. There is no problem in our social life which people ought to study with greater diligence than this. It is the key to the suppression of contagious diseases, and the delivery of mankind from at least half the causes of their disease and death. Let us, then, study cholera from these three points, and first ascertain what we know about the poison of cholera.

At first sight it might appear that we could *know nothing* about the laws which regulate the

nature of a poison whose presence we had never been able to detect, and whose very existence has been denied. But when we call to mind the fact that the poisons of ague, of scarlet fever, of diphtheria, of measles, and of hooping-cough, have never yet been separated and observed, and that few are bold enough to deny their existence, we shall see that the poison of cholera may be regarded as a special existence, as much as any of these poisons. In the case of small-pox above alluded to, we have been able to separate the poison. We know that it consists of particles of matter which have been generated in pustules in the skin, and reasoning by analogy, we are led to believe that the germs which produce scarlet fever and measles, are likewise produced upon the skin. There is a close resemblance between the structure of the skin and the mucous membranes of the alimentary canal. Now, cholera is eminently an affection of the mucous membranes of the stomach and bowels, and we have thus reason to believe that just as poison germs or cells are thrown off the structure of the skin in small-pox and scarlet fever, so poisonous cells or germs are thrown off from the mucous membranes of the bowels during an attack of cholera. The difference between the *ordinary discharges* of the bowels and those

which take place in cholera, is as great as the difference between ordinary perspiration and the exhalations which pass off from the skin in scarlet fever. One is perfectly harmless, the other produces a specific disease.

Cholera is not the only disease which affects the lining membrane of the stomach and bowels, and whose action is to produce a poison on the mucous membrane. There is a disease very common in this country, known as gastric or typhoid fever, the disease to which the late Prince Consort fell a victim, which consists in an affection of the mucous membrane of the bowels, and which renders the discharges from the bowels highly contagious. This disease in the mode of its propagation, and the nature of its poison, greatly resembles cholera, but the action of its poison is not so sudden or fatal as that of cholera; and being a native of our own soil, and constantly amongst us, we give it much less attention than we do to the stranger from the East, who stalks in upon us occasionally and alarms us so much, although in the last twenty-five years it has done us infinitely more harm. We shall have reason after all to thank the stranger, if he teaches us how to destroy his brother, who is native to our shores.

All the evidence on which we rely for proving

that cholera is a contagious disease, points to the evacuations of the patient as containing the poison germs. How these poison germs are distributed may be more easily conceived than described. But in a large number of isolated cases of the occurrence of this disease, unmistakeable indications of contact with the poison germs from the evacuations are given. These germs, although more easily communicated through the agency of water, can undoubtedly be received through the air. Thus we find persons frequenting water-closets where cholera patients have been, have contracted the disease. This was probably the way in which the farmer at Theyden-Bois, near Epping, first contracted the disease, which he carried from Weymouth to his home, and which produced such fatal effects in his family.

In one of the cases at Southampton, so elaborately detailed in the report of the Medical Officer of Health of the Privy Council, it was found that one of the persons who died had been engaged the day before in attempting to unstop with a stick a public water-closet which had got blocked up with feculent matter. In a large number of cases the breaking out of cholera in an uninfected district has been clearly *traced to persons coming* from infected districts.

Take the followir that when first
A boy aged 8 year ully opposed.
the 7th of August ce of any
ill of cholera, to s ved in
uninfected street at act.
He was attacked w
Friday, the 9th of A
uncle, who had not b
trict, had the disease th of
August. This could nardly be a coincidence, and could be explained on no other theory than the boy bringing the disease from a place where it existed, and communicating it to an individual where the disease had not previously been known.

Another set of cases, which show the contagiousness of cholera, are those in which persons who wash the clothes of those who have died of this disease have been seized with cholera. All these instances seem to prove that the cholera poison may be conveyed through the air as a medium. Another curious set of cases are those on which the dried excretions of cholera patients are carried by draughts of air into buildings and other places in contact with them. A surgeon in India relates, that on one occasion after the existence of cholera in a particular district four European soldiers, who had

that cholera is real, were attacked with cholera. the evacuations of the sufferers thus attacked had their beds the poisonous effluvia of two open doors which were opposite each other in the hospital. The only explanation of this circumstance was to be found in the fact, that the dust from the outside was copiously blown in by a wind during the night, and that this dust contained the dried excretions of persons who had been known to be attacked with cholera, and who had, after the manner of people in the East, deposited their excretions on the ground in contiguity with the hospital.

The poison of cholera may be easily conveyed by the hand to the mouth. Thus where attendants are not cleanly after attending to the wants of those diseased with cholera, and not careful of washing, they may, by placing their fingers in their mouths, convey the poison to their mucous membranes. Food taken by persons thus circumstanced may be poisoned, and produce the disease. Even the affectionate embraces of relatives, when parting with dying friends, may carry the poison of one mucous membrane to another, and thus produce the disease.

But of all the means by which this poison may be conveyed, that by water seems the most *constant and the most* dangerous. This mode

of conveyance was so novel, that when first suggested it was almost universally opposed. Medical men had really no experience of any contagious diseases that could be conveyed in this way, and were incredulous as to the fact. In the first epidemic, of which we had any experience in this country, there were certain facts which led to the supposition that it might be water that produced, in some way, a tendency to this disease. It was especially in London that this idea gained ground, and an experiment, on a vast scale, seemed to have been performed on a district supplied by water from the Thames. When the cholera prevailed in London in 1848, the district of Lambeth was more afflicted in proportion to its population than any district in London. It was observed that this district was supplied with water by companies that derived their supply from below Battersea Bridge, and consequently from a part of the Thames peculiarly subject to contaminations from the sewers which emptied themselves into this river. This district was supplied by two companies, the Lambeth and the Vauxhall, which delivered their water throughout Lambeth in such a manner, that each company supplied the same streets, and almost the same houses. At this time an Act of Parliament was passed compelling all the

water companies supplying London from the Thames to draw their supplies beyond the influence of the tide from above Teddington Lock. Between the years 1848 and 1854 the Lambeth Company had opened its works beyond Teddington Lock, whilst the Vauxhall Company was still supplied from its old source. When the cholera reappeared in 1854 it was found that the houses which were served with the water supplied by the Vauxhall Company suffered in the proportion of seven to one compared with those supplied by the Lambeth Company. We think there is no other explanation of this extraordinary fact, than that the water of the river Thames below Battersea was contaminated with the poison of cholera, whilst that supplied from above Teddington Lock was free from this influence. We give this instance as a proof that the poison from the excretions of human beings may pass into drains, and from drains into sewers, and from sewers into rivers, and thus disperse the poison to vast masses of a community.

That the same influence may be conveyed from a water-closet to a well, is seen in the case of the people attacked at Theyden-Bois, near Epping; but the most gigantic case of this kind which has ever appeared in the history of epidemic cholera, is that which occurred in the

months of August and September, 1854, in the parish of St. James, Westminster. This case demands attention, not only on account of its completely demonstrating the fact that the cholera poison may be conveyed by water, but on account of its showing that of all sources of unsuspected danger, the pump of a surface well may be most fatal and destructive in its influences. In the parish of St. James, Westminster, is a street in the district of Golden-square, known by the name of Broad-street. It is a wide street, and healthy, because it is wider than the height of the houses on either side. In this street stands a pump, an ordinary street pump, connected with a well about 25 feet deep. The water percolates into this well through a loose gravel extending for several hundreds of yards to its north and west. All this gravel is covered with streets and houses, and in it have been dug innumerable cesspools, and through it pass numberless drains —brick drains, rat-eaten, filthy, corrupt drains, and also sewers—bad sewers—some of them in the immediate neighbourhood of the pump only half a brick thick. Such drains and such sewers as only a country regardless of its health would tolerate. This pump in the year 1854 was a popular pump. From the soakage of human secretions, and their oxidation in the loose gravel,

the water was loaded with cooling salts and carbonic acid gas, formed from the oxidized carbon of human excretions, which made it lively to the eye and pleasant to the taste. It was a popular pump, just as the pump opposite St. Martin's church is popular at the present moment, because of its coolness and liveliness. At the latter end of August, 1854, a case of diarrhœa occurred in a house directly opposite the Broad-street pump. It was the case of a child—it was only diarrhœa in a child! No precautions were taken to disinfect this child's evacuations. All its excretions were emptied into the closet, and there was no one to inquire where next they might pass. On the night of the 31st of August, there was weeping and lamentation in all that district. The shadow of the angel of death had passed over it. The authorities were paralysed, the population was in dismay, lime was thrown on the roads, and black flags hung at each end of Broad-street. On the 1st of September the Board of Guardians met to consult as to what ought to be done. Of that meeting the late Dr. Snow demanded an audience. He was admitted, and gave it as his opinion that the pump in Broad-street, and the pump alone, was the cause of *all the pestilence.* He was not believed—not a *member of his own* profession, not an individual

in the parish believed that Dr. Snow was right. But the pump was closed, nevertheless, and the plague was stayed. Six weeks after, the vestry of St. James, Westminster, appointed a committee to inquire into the origin of this sudden and terrible outbreak of cholera. It was calculated that upwards of 500 people, in a district not numbering 4000 souls, had died in three days. The inquiries of this committee were conducted with the greatest possible precision. On it were several scientific men, and after three months' investigation of the most careful and accurate kind, they unanimously came to the conclusion that the water of the Broad-street pump was poisoned on the 31st of August, and that the outbreak of cholera in the district of Broad-street, Golden-square, depended entirely on the poisoned nature of the water of that well. The evidence adduced was most circumstantial and conclusive. It was shown that no condition of the atmosphere or the soil or the locality could in any way account for the outbreak of the disease. It was also shown most conclusively, by laborious personal investigation, that in a large majority of the instances of persons attacked or destroyed by cholera that they had drunk of the water of this pump. It was demonstrated that, in a large factory directly opposite the

pump, the men who drank the water died of the disease, whilst those who did not were not affected. The men who worked at a large brewery close to the pump, who never drank the water, were none of them attacked. It was shown by a map that the greater number of those who died died in a circle round the pump and had drunk the water on the 31st of August. It was clearly demonstrated that certain persons lying beyond the circle of the pump had been in the habit of sending for the water of this pump on account of its popular qualities. A manufacturer who lived near the pump was in the habit of sending a quantity of the water every day to his mother, who lived at West-end, Hampstead. She died of cholera, and a niece also who accidentally visited her and partook of the water. The evidence was most full, complete, and conclusive as to the relation of the disease to the taking of the water. When all these facts had been made out, the well was opened and examined, and it was found that a direct communication existed between the well and a cesspool in the house in which the first case of cholera had occurred in the neighbourhood.*

* Report on the Outbreak of Cholera in the parish of St. James, Westminster, in 1854. London: John Churchill.

We now leave the question of the contagiousness of the disease; there can be no doubt of it, we think, after the evidence to which we have alluded. It is still an interesting point for discussion as to whether the poison of cholera, after it has passed from the human body, has the power of increasing or multiplying so as to widen by a living action independent of the human body the sphere of its action. This question must of course at the present time be problematical, seeing no one has succeeded in isolating and experimenting upon the poison. Nevertheless there are some facts which enable us to speculate with tolerable certainty on the nature of this poison.

In the first place, then, it appears that the poison retains its vitality for a long period of time. An instance is related in Edinburgh during the epidemic of 1848-9, that on its recurrence in 1849 a woman was sent down to a receiving-house which had been shut up for several months, for the purpose of cleansing it and fitting it for the reception of fresh patients. This woman, without any communication with other cholera patients, came home from the house she had been cleaning with symptoms of cholera, and died in a few hours.

German writers record cases in which it seems

as though the poison-germs had the power of multiplying and growing when they came in contact with certain kinds of soil. Thus the soil of cesspools and privies when thrown upon the ground for agricultural and horticultural purposes, seems to have been peculiarly favourable to the growth and development of the poison of cholera. It seems as if the poison might actually traverse the air, and alighting on these appropriate beds like the spores of fungi in the air, could reproduce themselves and again give germs to the air. The occurrence of cholera in London in 1848 and in 1854 in the neighbourhood of grave-yards where the soil was recently opened, and in streets which were opened for the purpose of laying down gas or water pipes, led many eminent physicians, amongst whom may be named the late Dr. Hodgkin, to suppose that the poison of the cholera found in this kind of soil a nidus on which it might develope itself and be diffused through the air around.

The same theory has been proposed to account for the contamination of water. It is supposed that the quantity of poison passing from a cholera patient into a well or a river, would be so diluted that unless it had the power of multiplication, it would be impossible to account for the rapid and wide increase of the disease from

the drinking of impregnated well and river water. It may be as well to add that such a view as this is not at all incompatible with the known nature of the cells of the human body, of which the poison probably consists. The poison cells of small-pox are but changed cells of the same nature as those found in the human blood, and as no insurmountable objection exists to the supposition that even these may grow, as well as live out of the body, there is no reason why we may not apply this view to the explanation of certain of the phenomena of the communication of cholera.

CHAPTER V.

THE CAUSES OF THE TENDENCY TO TAKE CHOLERA.

WHATEVER may be the exciting cause of a disease, whether a poison or some other external agent, it will always be found that some persons are more liable to take the disease than others. This is called *predisposition.* Thus, four men may be riding on the outside of a coach on a cold day, two will contract inflammation of the lungs, one will die, and the other get well, but the other two will not be attacked at all. The two first were predisposed to take the disease; the one who died more predisposed than the one who got well, but the two who did not take the disease were not predisposed at all. So of two children exposed to the poison of small-pox, one will take it, the other not. On inquiry, we find that the one who did not take the disease had been vaccinated. The fact is, vaccination takes away the predis-*position to take* small-pox. The same thing

exists with regard to all diseases. In districts where cholera prevails, we find that it is only a certain number of persons who take the disease. This number varies in different localities. Lamentable instances have occurred where almost all the individuals living in a particular locality have been seized, and other instances occur where the disease is introduced and only a few individuals take the disease. The stronger the predisposition to take the disease, the more liable the person is to die; and instances are constantly occurring in crowded neighbourhoods where only one family is attacked, and every member of this family will perish. It is therefore of considerable importance to ascertain what are the conditions that favour the development in the human body of a predisposition to take cholera.

Now, there are four things which are more especially necessary for the maintenance of the body in good health, in a state in which it will not be predisposed to take any disease. These are, fresh air, pure water, good food, and warmth. The deprivation of any one of these four may engender a state of the system in which it will be predisposed to take cholera, or any other disease. We will now briefly examine the con*ditions under* which these agents act on in-

viduals, for the purpose of showing how their deficiency may invite the action of the poison of cholera.

1. *Fresh Air.*—An atmosphere composed of twenty-one parts by weight of oxygen, and seventy-nine parts of nitrogen, is necessary to the existence of every animal being; alter these proportions, and disease is the result. The provisions for the maintenance of these properties in our air are so perfect, that we seldom find them disturbed. Even in our overcrowded towns the constituents of the atmosphere remain the same. It is not then in the changed proportions of the grand constituents of the atmosphere that we must look for an influence on the system producing a predisposition to disease, but in the *quality* of these constituents and the presence of *foreign substances.* And first, with regard to quality: it is now above twenty years since, that Professor Schönbein, of Bâle, announced the discovery of an agent in the atmosphere, which he called *ozone.* This substance is now known to be a changed or more active condition of the oxygen gas of the atmosphere. It possesses all the active properties of oxygen in a more intense degree, and its presence may be detected in the atmosphere by *certain re-agents on* which it acts with greater

activity than ordinary oxygen. Ozone is found in the atmosphere in country districts, by the sea-side, and on mountain-tops, more especially when the wind is blowing from the south or west. Its action on the system is highly favourable to health, and during its absence the human body exhibits a predisposition to certain forms of disease. So evidently is this the case, that certain writers have unhesitatingly referred a predisposition to take the cholera poison to an absence of this agent. During the prevalence of cholera in London in 1848 and in 1854, a great deficiency of ozone was observed, as indicated by the test papers ordinarily employed for detecting this agent. The same observations have been made in India. Dr. Cook, who has reported on the subject of "Ozone" to the government of Bombay,* states, that on one occasion he was riding away from the station of Ahmednugger, having left his wife residing there, and he was struck by the slight influence the atmosphere was exerting on the ozone test paper which he usually carried in his hat. So important did he consider this phenomenon, that he sent a messenger to warn his wife, to request her to leave the station.

* "Sanitary Notes," by J. J. Pope, Esq. Journal of *Social Science*, September, 1866.

In three days cholera broke out with great virulence, and raged in and around the cantonment for some period. Now, it is not suggested that the unozonised air conveys the cholera poison with more facility, but that an atmosphere destitute of ozone renders the system more susceptible of the action of the choleraic poison, that is, predisposes the system to attacks of cholera. There are many ways by which this action could be explained, but we think it sufficient to indicate the facts as they have been given by competent observers.

In the next place the air is subject to the introduction of foreign agents, which exert a depressing influence on the system. Thus the atmosphere contains varying quantities of moisture, and it has been found that both excessive dryness and excessive moisture exert a depressing influence on the system, and both conditions have been recorded as favourable to attacks of cholera. Over this and the foregoing agent man has but little power when they exist generally in the atmosphere of a district. It is over the existence of what may be called foreign agents that man has most influence.

Thus, *carbonic acid* is being constantly poured into the atmosphere from the lungs of human beings and other animals and from candles and *gas. Naturally this gas* is speedily dispersed

throughout the whole atmosphere; but when human beings are kept in close rooms, and even in close streets and alleys, this gas may accumulate to an extent to exert an injurious and depressing effect upon the system. Carbonic acid gas, which is formed in the blood of all animals during the processes of life, is so decidedly a poison that an animal prevented from throwing it out from its lungs dies in the course of three or four minutes, as seen in the processes of hanging and drowning. One of the great evils of our civilization is the crowding of men and women into close rooms, where their systems are constantly exposed to the action of this gas. Persons thus situated are known to become the subjects of scrofula and consumption, two of the greatest scourges of civilized human beings. There can be no doubt that where human beings are constantly exposed to the action of this agent their system becomes depressed, and they are predisposed to take the poison of cholera. It has always been in the close, low, unventilated buildings of our great towns that cholera has prevailed to the greatest extent. Such places do not generate cholera; they offer a fitting means for the diffusion of the poison, and it is in them that those persons dwell whose systems are most susceptible of the action of the poison of cholera.

The air of close and unventilated rooms is also exposed to many exhalations from the bodies of human beings, and from the various things in the room. These matters are quite impalpable; but they collect especially on the glass windows of such rooms, and can be revealed to the curious by the aid of the microscope. They consist of cells of decaying animal and vegetable matter, which frequently afford a nidus for small living beings to live upon. Such particles taken into the lungs interfere more or less with the absorption of oxygen into the system, and have a tendency to produce those changes in the vital organs which make the system predisposed to yield to the action of the poison of cholera, and to increase its influence when once established.

All these facts with regard to the nature of the influence of the atmosphere on the system point to the necessity of *cleanliness* and *ventilation*.

2. *Pure Water.*—We have spoken of the agency of water in conveying the cholera poison, but quite independent of this action water may exert an injurious effect upon the system, and render it predisposed to attacks of cholera. Water, as supplied to our towns, is seldom pure. It is derived principally from two sources, from rivers and from wells. Under these circum-

stances it is constantly impregnated with saline or mineral and organic matters. A few grains of saline matters in the gallon of a quality similar to those contained in the blood are not injurious; but very small quantities of substances not contained in the body, as lead, will act injuriously. A quantity of saline matter, exceeding forty grains in the gallon, should render a water suspicious, and where purgative salts are found in water, as Epsom salts, Glauber salts, and others, there is no doubt their presence may lead to a state of the bowels which would predispose to the reception and fatal activity of the cholera poison.

It is, however, the *organic* impurities of water that are most likely to act injuriously on the system. They are derived from the decomposition of animal and vegetable substances, and may be derived from living organisms or from matters introduced from the sewage of houses. Unfortunately, both our river and well waters are liable to this latter contamination. The quality may be easily tested by what is called the permanganate test. A few drops of a solution of permanganate of potash (one grain to the ounce) may be used for this purpose. If the permanganate loses its colour in the water it contains organic matters. An equal quantity

of water of known purity may be employed in testing, and the difference in the colour of the two will indicate the amount of organic impurity. Water may be very bright when drawn and yet be charged with a considerable quantity of organic matter. In the summer, when such waters contain less oxygen, they are liable to become putrid, and on being taken, to irritate the bowels, and in this way predispose persons to receive the poison of cholera.

In the summer especially, and at all seasons when cholera is prevailing, it is a safe plan to boil water, and when cold to pass it through a filter before drinking it. The surface well-pumps of London are especially liable to contamination, and on this account ought to be avoided. Even in the country, away from large towns, a practice exists of placing the cesspool within a few yards of the pump; and should any leakage take place from the former to the latter the consequences to health may be at all times disastrous, but when cholera prevails may be fatal.

3. *Good Food.*—There is no proper nourishment of the organs of the body without good food; and unless the organs are properly nourished there will be no sound health, and the body will be predisposed to take disease. Cholera

is not like relapsing fever, a disease of famine, but where famine prevails in a district there cholera will be most fatal. It is amongst the ill-fed portions of our population that we find this disease slaying the largest number of victims.

The question may be asked here as to what is good food, so that this need may be supplied. Food serves two purposes in the system: first, it maintains the heat of the body, and secondly, it renews the flesh that is wasted by the action of the nerves and muscles. The first action is produced by starch, sugar, and fat; the second, by albumen and fibrine, which are contained in bread and the flesh of meat. In bread we have starch and fibrine, a heat-giver and flesh-former. In butcher's meat we have fat and fibrine, a heat-giver and flesh-former. In vegetables we have certain mineral matters which are also necessary for the nutrition of the body. In all good food there should be these agents. In addition to these kinds of food man takes certain nervous stimulants with which he flavours the hot water which he finds necessary to take into his system. These are tea, coffee, and cocoa. A good breakfast consists of bread-and-butter, bacon and eggs, and hot tea, coffee, or cocoa. A good dinner consists of a slice of meat, with bread and potatoes or other vege-

tables. A good supper consists of bread and milk, or bread and cheese, with coffee or cocoa. Of course this diet can be varied, and the substantials cooked in a hundred different ways; but some people are at a loss to know what is meant by good food, and think that unnecessary luxuries should enter into its composition. Now, it is not amongst those that live on the food we have mentioned that predisposition to cholera is produced. The food, however good, may be deficient; and from this cause a feebleness of the system is produced which invites attacks of cholera.

The food amongst the lower classes is often of an improper kind and not fresh. When one kind of food predominates over another it produces unfavourable results in the system. Thus potatoes, when made a substantive article of diet, as they contain too little nutritive matter, often lay the foundation of predisposition to disease. Disproportionate quantities of other vegetables, as carrots, turnips, and potatoes, produce disorder of the bowels. On the Continent weak soups are often taken by the poor people in large quantities, and render them predisposed to attacks of cholera. In Russia there is a taste for taking these soups with ice, and people were recently warned of the danger they ran. In

1832, Dr. Tytler pointed out that damaged [rice eaten by the natives of India was a source of predisposition to cholera, and he was inclined to attribute the cholera in Europe to the use of this damaged rice. Whether this was the case or not, there is no doubt that food of any kind in a state of *decay* is a source of derangement to the bowels, and invites in the system attacks of cholera. Numerous instances are recorded in which persons have been attacked with cholera soon after eating meat or fish which has in any way become tainted. Milk is very liable to become sour, which is the result of a change which is highly prejudicial to health, and there can be little doubt that a large amount of the summer and autumn diarrhœa of this country, which is often so fatal amongst children, is due to the use of sour milk. Hence we comprehend under the name of good food not only food that is right in quality, but such as is sound and free from taint of any kind.

Under the head of food we must include beers, wines, and spirits. These alcoholic drinks are consumed extensively amongst the inhabitants of Europe, and whilst there is no evidence to show that the moderate and temperate taking of these beverages is injurious to health, there is abundant proof that the excessive indulgence

in them is one of the most fertile causes of a predisposition to take cholera. It has been abundantly proved by the practice and experience of teetotallers that beer, wine, and spirits are not necessary to a healthy existence. There is no evidence to show that persons who drink nothing but water are more liable to cholera than those who drink alcohol. It is true, that where persons are exposed to the drinking of poisoned water, then those who drink nothing but water are more likely to be attacked than those who drink nothing but beer or wine. It appears that those who drink spirits and water are equally exposed with teetotallers, as the spirit does not appear to destroy the poison-germs of cholera in water. Whilst raw spirits act so injuriously on the coats of the stomach that it may be questioned which is the most dangerous poison, that of cholera water, or ardent spirits.

4. *Warmth.*—Even in our hottest summers exposure of the person to cold will generate disease. Instances of sudden attacks of cholera have been known to take place by persons riding for long distances on the outside of coaches, or otherwise exposing themselves to cold. In the autumn of the year when cholera has most frequently visited this country, although the days

are hot the nights are cold, and exposure to the cold of night with insufficient clothing is calculated to invite an attack of cholera when the poison is present in any particular district. It seems very important that the abdomen should be kept warm, hence the very general recommendation of those who have seen an epidemic of cholera that persons should wear during the prevalence of cholera extra clothing, or at any rate a flannel waistcoat.

5. *Sex and Age.*—The influence of sex and age on the predisposition to cholera varies. It is, however, very certain that persons of adult age are more liable to the attacks of this disease than children. During the present epidemic in the east of London this has been observed. In the week ending August 4th it was found that there were 1053 cases of cholera; of these 457 cases occurred in children and 596 in adults. In an attack of cholera experienced by our troops in Canada, the following is the ratio per 1000 of those who died :—

Years.		
From 18 to 25	. . .	15 in 1000.
„ 25 to 33	. . .	23 „
„ 33 to 40	. . .	36 „
„ 40 to 50	. . .	70 „

It appears also from statistical returns in

towns that women are more subject to this disease, or it is more fatal to them than men. Of 145 fatal cases in Sunderland, 63 were males and 82 were females.

It appears that the black and coloured races of mankind are more predisposed to take the cholera and to die with it than the white races. As far as returns go from various parts of the world this is borne out. In Hindostan the natives are certainly much more liable to the disease than the Europeans, and suffer proportionately. The slave population of South America have always suffered very severely when the disease has been introduced amongst them.

The number of persons attacked by cholera in a community has always varied very much, and this has evidently depended on the amount of energy and intelligence brought to bear on the taking of means for its prevention. There is undoubtedly a limit in every community beyond which it cannot go. What that limit is it would be impossible to define; but as with other contagious diseases so with cholera, there are some persons who have absolutely no predisposition to take the disease. The reason why these persons do not take the disease we cannot say; but they form the natural barrier

against which the waves of contagion surge in vain. They constitute the means which Providence employs to prevent the destruction of the whole human race by any plague.

A French writer gives the following table of the number of persons attacked in the different countries of Europe:—

France	1 in 300.
Russia	1 in 20.
Austria	1 in 30.
Prussia	1 in 100.
Belgium	1 in 120.
Great Britain . . .	1 in 130.
Holland	1 in 144.
Germany	1 in 700.

From the foregoing remarks it will be seen that a variety of external causes act upon the system, and engender in it a liability to take the poison of cholera; but these things must not be regarded as the true cause of cholera. They may exist in the utmost intensity, and will never produce true epidemic cholera. This comes by the agency of a poison which is brought to the abodes of those who have not fresh air, pure water, good food, or warm clothes. This poison, in spite of the presence of all these agents of health, will now and then smite down the

apparently healthy, the cared for, and the wealthy; but it does not spread amongst them. The doctor occasionally dies, the nurse is smitten at her duties, the clergyman or the missionary are seized; but the disease does not spread in their houses, where the poison is diluted by abundance of fresh air, and all the appliances that intelligence can employ are made use of.

CHAPTER VI.

HOW CHOLERA POISON IS CONVEYED.

In the preceding remarks we have had to anticipate much that might properly be said under this head. The great means by which the cholera poison is conveyed, are obviously the air, water, and personal contact.

1. *The Air.*—The great means by which the poison of scarlet fever, measles, typhus, and small-pox are conveyed, is through the air. In these cases the disease affects the skin, and from the surface of the skin the infecting poison is carried to the lungs through the air. The difference between cholera and these diseases is, that the cholera affects the mucous membranes of the alimentary canal, and the poison is there produced. It is, therefore, much more likely to be conveyed by water, but just as scarlet fever poison may be carried by water though its natural agent of diffusion is the air, so the poison of cholera may be diffused through the

air. There is reason to believe that the poison fumes of cholera may immediately escape into the air from the evacuations, and the case of persons taking the disease in carrying or washing the linen of the diseased, or in attending upon them, seem to indicate this fact. There are also facts that seem to show that where cholera excretions have been allowed to dry upon the soil, exposed to the influence of the sun, that a draught of air or breeze may blow the dried excretions of the soil into the residences of human beings, and thus communicate the disease.

It is, however, very questionable as to whether the poison is of a nature to diffuse or propagate itself in the air. We are greatly indebted to Mr. Glaisher, of the Royal Observatory, Greenwich, for his careful observations on the meteorological conditions which accompany cholera visitations, and he has lately described a "blue mist" which he saw in 1854, and which has again appeared in 1866. This observation is very interesting, and if it were found that this mist existed in greatest abundance when cholera breaks out, and that it contained matters which could in any way be made to produce cholera, it would be highly important. At present sufficient is not known of this agency for us to be

able to pronounce that it has any connexion with an outbreak of cholera.*

2. *Water.*—The cases referred to, when we were treating of the poison of cholera, are sufficient to show that water is a more common medium for the diffusion of the cholera poison than air; and we see how this is when we consider that the contents of the bowels naturally come in contact with water in the soils or rivers where they find their destination. This fact is of the utmost importance, as it alone explains the cause of those sudden, irresistible, and devastating outbreaks which occur in the midst of the cities of Europe. To say nothing of the present outbreak in the east of London and of others in many parts of England and the continent of Europe, let us once more draw attention to the two great typical cases—the outbreaks in Lambeth in 1848 and 1854, and the outbreak in Broad-street, Golden-square, in 1854. Both these causes are so conclusive as to the water of the Thames and the water of the Broad-street pump causing the cholera, that no other theory is at all tenable. The water of the Thames which supplied Lambeth was exposed to cholera evacuations from the drains

* See Appendix A.

and sewers of London; the water of the Broad-street pump was exposed to the contents of a cesspool in a house where a person had been attacked with cholera.*

The practical lesson to be derived from this knowledge is the fact that no community is safe from cholera that is dependent for its supply of drinking-water on rivers receiving sewage, or on wells that may communicate with drains, cesspools, or water-closets. Now, this is an alarming statement, but it must be looked in the face. A question here arises as to whether it is so far possible to dilute the poison of cholera as to render it comparatively innocuous. Reasoning by analogy, we may suppose that cholera poison may be diluted in the water just as typhus fever poison is diluted in the air. We know that a typhus fever patient may be so placed that the poison which escapes from his body shall be so thoroughly diffused that it will not attack another person. Now this is possible with the cholera poison; and it may be that even should Reading or Oxford suffer from cholera that the poison of their sewers will not reach London. There is even good grounds

* "Report on the Cholera Outbreak in St. James, Westminster, 1854." Churchill.

"On the Communication of Cholera." By John Snow, M.D. Churchill.

for believing that it would not. Water when exposed to the air absorbs oxygen, and always contains considerable quantities of this gas. Now, as long as the organic matters are not in overpowering quantity, it is the property of this gas to oxidize these matters, to destroy their putridity, and to prevent their becoming injurious to man. It is from this cause that river-waters, which receive considerable quantities of sewage matter, have been found free from organic contaminations.

It is not, however, well that people should depend on such an agency for the purification of those rivers from which drinking-water is derived, and where there is the least suspicion of the conveyance of so dreadful a poison as that of cholera every precaution should be taken. It is well known that most animal poisons are destroyed at the temperature of boiling water, and this offers a simple means of rendering uninjurious any suspected water. A more effectual way of purifying water has been recently and strongly recommended by Professor Frankland, and that is, of passing it through animal charcoal. If water then is first boiled, and then filtered through a filter composed of *animal charcoal*, it may be taken with impunity.

3. *Contact.*—There can be no doubt that amongst those who are habitually negligent of

personal cleanliness, direct contact with the poison from the mucous membranes of such persons is a constant means of communicating the disease. Persons attending upon the sick perform for them offices which must necessarily bring their hands in contact with the poison; and if they are not careful to wash and use disinfectants, they may easily by taking food, or by other means convey their hands to their mouths, and thus swallow enough of the poison to render them liable to an attack of the disease. This leads us to observe how thoroughly necessary is absolute *cleanliness*. It is the cleanliness of those who nurse and attend upon the sick in our great hospitals that spares them from the attacks that so often fall upon those who are careless of their persons and ignorant of the laws of this disease.

CHAPTER VII.

HOW TO PREVENT CHOLERA.

THE preceding chapters have been written with the view of giving information to the public on the nature of cholera, under the conviction that it is only by an intelligent apprehension of the laws which govern the development of this disease on the part of the great bulk of the community, that we can ever hope to prevent its appearance or arrest its progress when it has appeared. It must, then, be very evident that there are two things, or sets of things, to be done:—1. To secure for ourselves and our neighbours such a state of bodily health that we may not be predisposed to take the disease. 2. To take all possible precautions against the introduction of the poison of cholera.

With regard to the first object to be attained it has this advantage, that what is good against cholera is good against almost all other forms of disease.

One of the most essential things to good

health is *fresh air*—air unadulterated with mineral, vegetable, or animal impurities. It may not be possible for every one to obtain perfectly pure air, but every effort should be made to do so, and every one should reflect that *ceteris paribus*, the person who breathes the most fresh air will live the longest. All persons engaged in sedentary pursuits should strive to obtain fully two to three hours' exercise in the open air every day. Not only is the air beneficial, but the exercise also. The heart, the lungs, the muscles, the stomach, the bowels are all benefited by exercise in the open air. The air of the closest streets and courts in London is better than the air of close and ill-ventilated rooms.

Next to exercise in the open air, the ventilation of sitting-rooms, bed-rooms, workshops, schools, chapels, churches, places of amusement, should be attended to. In this operation two things should be regarded,—first, the getting rid of the *bad air*, the carbonic acid gas, and other impurities from *within;* and second, the *letting in* of fresh air containing oxygen from *without*. Fires ventilate rooms in cold weather by drawing the air of the room up the chimney, and thus allowing air to come in from without. But all rooms without fires should be ventilated by letting down the top sash of the window, or

by ventilating panes in the windows or valves in the chimneys. All these arrangements should be made so as not to expose individuals to a draught of cold air. A draught is occasionally unavoidable for the purpose of ventilation, but the want of fresh air is the greater evil of the two.

The *overcrowding* of rooms should be avoided. In either sitting-rooms or bed-rooms where there are less than 500 cubic feet of space to each individual, the room may be regarded as overcrowded. It is in the overcrowded rooms of the poor of London that cholera and other diseases find the largest number of victims.

In order that the air of a room may be fresh everything in it should be *clean*. Dirty walls, dirty floors, dirty carpets, dirty beds, dirty curtains, dirty clothes, and dirty skins, all contaminate the air and render it unfit to breathe. A room should have no smell, and directly any unpleasant smell arise its source should be discovered and removed. Dwelling-rooms should be whitewashed at least once in the year, and oftener when obviously dirty. The floors of rooms and stairs should be scrubbed once a week. Rugs and mats should be beaten every two or three days. Better to have no carpets than dirty ones. Bed-curtains should be dispensed with. They are a nuisance when clean,

and a source of disease when dirty. Bed-linen should be changed once a fortnight, and bedsteads taken down and cleansed once a year at least. Dirty slops should be at once emptied out.

Personal *cleanliness* should be secured by washing and bathing. Children should be washed at home from head to foot at least once or twice a week. Grown-up persons, male and female, should bathe frequently. In all our large towns there are baths which can be made use of at a low price by the poor.

Bad smells may arise from many sources outside the room, and should be looked after.

Dust-bins or ash-pits are receptacles necessary for the cleanliness of the house, but they never ought to smell. They should be emptied at least once a week. They frequently smell on account of the lazy habit of servants and housekeepers of throwing in with the cinders and other dry dust vegetable and animal refuse. All such things, if not otherwise made use of, should be thrown on to the fire. In all our large towns there are dustmen, who are compelled to remove the dust whenever called upon to do so.

In all cases water-closets should have a constant supply of water. It should be remembered

that every closet which lets water down to a drain may allow bad air to come back, so that the traps should be looked to regularly and kept well charged with water. Privies should be placed at some distance from the house, and the seat should be constantly covered and ventilation secured through the door. When contagious diseases of any kind exist in the house, some form of disinfectant should be thrown down every day. Cesspools should not be emptied in hot weather.

The drains of houses should be constantly looked to, as when improperly constructed or not trapped, they may allow dangerous emanations to escape into the house.

Offensive businesses in crowded neighbourhoods, such as the keeping of cows, horses, pigs, poultry, or other animals, the slaughtering of animals, the boiling or storing of grease or other animal matter, are all liable to indictment, and when such businesses are productive of bad smells and injure health, they should be got rid of.

All these sources of bad smells and injury to health may be dealt with by law. It is the duty of the landlord, with regard to the great mass of the houses occupied by the poor of England, to attend to the cleaning of the

house, and the state of the drains and the water-closets. Wherever the local authorities are called upon to act, they should take powers under the "Nuisances Removal Act," which is not only operative for London and the large towns of England, but for the country. Many of the evils arising from these causes which expose the populations of our small towns and villages to attacks of cholera are removable by the application of this Act. The "Sanitary Act of 1866" is more stringent still, and gives great powers to local authorities for the removal of all nuisances productive of disease. It is to be hoped that medical men, clergymen, and the wealthy inhabitants of our rural districts will feel that the health and lives of a large number of their fellow-creatures are dependent on their public spirit, patriotism, and Christian charity, in carrying out Acts of Parliament which have been passed to cure evils which deeply oppress and injure the poor population of this country.

We next come to *water*, and on this subject so much has been said that it can only be necessary to repeat here, that one great means of maintaining the health of a community is the supply of pure water. It is, however, not only necessary to have a source of pure water, but as in many cases this water has to be stored, it is

necessary to look to the storage. It would be better if this could be done by the water company and the water supplied constantly, but at present this is out of the question, and one thing we ought all to do is to look to our cisterns and water-butts. Cisterns and water-butts are too often neglected. They are frequently situated where the effluvia from water-closets and dust-bins pass directly into them, and the water is thus contaminated with sewer gases. They should always be covered, and at this season of the year should be emptied and washed out at least once a month. Quicklime should be used to cleanse the bottom, and wooden butts should be fresh pitched at least once a year. Where water is liable to contamination permanganate of potash may be added till it begins to tinge the water. The permanganate effectually destroys organic matter.

We have before spoken of the importance of boiling and filtering water before drinking it in seasons of epidemic cholera. It is not often that poor people can buy filters, the demand for them is not yet great enough to induce the earthenware manufacturer to produce a cheap one. In the absence of one ready made, a cheap filter can be extemporized by taking a pail or bucket, placing it over two pieces of wood, and

then standing over it a common flower-pot. The hole at the bottom of the flower-pot should be plugged with sponge, and then into the bottom is to be placed a layer of *animal charcoal*, not in fine powder, but in large grains like coarse salt or gunpowder. Over the charcoal is then to be laid a layer of sand and pebbles to keep it down, and water poured into it and allowed to filter through into the pail below.*

We now come to the question of how to prevent the introduction of the cholera poison into a country, a town, or a house. With regard to a country, this can only be done by the action of the Government, and by quarantine laws. There has been so much oppression carried on by the Governments of Europe through quarantine laws, that liberal politicians have been anxious to diminish their severity, and have hesitated to introduce new ones. Our own Government has in particular been tardy to enforce any restrictions on the commerce of this country for the sake of preventing cholera. Hence it has found its way to our own seaport towns almost as soon as possible. Thus it was

* Such a filter was to be seen in the food collection at the South Kensington Museum when that institution was conducted with the object of *instructing* the people in *what* concerns their daily welfare.

at Southampton and Liverpool in 1865, and has probably thus found its way to London in 1866. When once the poison has found its way into a country it is most difficult to check its progress by quarantine. Nevertheless, every reasonable precaution should be taken. The Legislature has in fact provided for extra powers being given to local authorities when an outbreak of cholera is anticipated. The following instructions have been recently issued by the Privy Council:—

When Cholera is in a Parish or District.

1. Every vestry or board shall make arrangements for meeting, where the disease is actually prevailing, daily, either in a body or in one or more committees, according to the exigencies of the parish or district, for the purpose of exercising the powers conferred upon them by the Act.

2. The meetings may be held at the ordinary board-room, and where necessary at such other places as shall appear to be most convenient for dealing with the disease, and the vestry or board shall cause proper minutes of all proceedings to be made and duly recorded.

3. The medical officer of health shall, as far as practicable, attend the meetings of the vestry or board, and of its committees, to render his advice thereat, and shall superintend all the

medical arrangements for preventing and treating the disease.

4. In each parish or district in which cholera is present, or, if the quantity of work to be done renders it desirable to subdivide the parish or district, then in each of such subdivisions, a legally qualified medical practitioner shall be put in charge of the parish, or district, or subdivision for the medical purposes of these regulations; and to each such medical practitioner (hereinafter named the medical visitor) shall be allotted such assistants as the vestry or board see fit.

Such medical visitor, where practicable, or in other cases one of his assistants, shall at least once daily visit those places assigned to him which are inhabited by the poorer classes and wherein the disease is, and shall there inquire at every house as to the existence of diarrhœa or cholera, and shall enter in a book to be kept for the purpose the facts as to all cases he may meet with, and shall without delay give, or take the proper steps for causing to be given, all necessary medical assistance to the sick. And the medical visitor or assistant shall, when visiting the places assigned to him, be provided with medicines for immediate administration in urgent cases, and shall be held to be in medical charge

of all cases of diarrhœa or cholera with which he may meet until he is relieved by such other provision for their medical attendance as may be made or sanctioned by the vestry or board.

5. Such medical visitor shall, by transmitting his above required book, or otherwise, report daily to the medical officer of health the result of his own and his assistants' inquiries, and shall report any nuisances which he or they find existing in any premises visited by him or them, and shall make such suggestions as to the state of the parish or district as he shall deem advisable.

6. The visitors shall, where they find it expedient, communicate to the relieving officer of the district any case of destitution requiring relief, which is not entered in his relief list; and such officer shall forthwith visit the same, and give such relief as in his judgment the case shall require.

7. The vestry or board shall provide a sufficient number of dispensaries, to be open night and day, at convenient places within their parish or district, with an adequate supply of such medicines, medical appliances and disinfectants, as their medical officer of health shall recommend, and with a legally qualified medical practitioner or skilled assistant always in attendance at each; and such medicines, medical appli-

ances and disinfectants, shall be dispensed without charge by such medical practitioner or assistant to persons bringing orders for the same from the medical visitors, and to other persons who apply for immediate medical treatment. And the names and addresses of all such applicants shall be sent to the medical visitor of the place in which they reside.

8. In every case of cholera or diarrhœa, where the patient is not under medical care and treatment, the vestry or board shall cause medical assistance to be rendered with the utmost expedition, and such aid and comfort, nourishment and accommodation, as the circumstances of the case will admit, with the object of restoring health.

9. The vestry or board shall provide competent nurses to aid every medical visitor in his attendance upon the patients suffering from the disease.

10. When the medical officer of health recommends, the vestry or board shall, with as much despatch as practicable, provide fit and proper accommodation for the reception of such patients as have no home, or cannot properly be treated at home, and may with advantage to themselves be removed, and shall cause the same to be provided with all appliances, medicines,

furniture, and other things necessary for the emergency, and shall appoint a legally qualified medical practitioner, with or without assistant, as the case may require, to attend to the same.

11. If cholera or choleraic diarrhœa exist in any dwelling whereof the medical officer of health reports that the sick and healthy cannot therein be properly separated, the vestry or board shall forthwith cause adequate accommodation to be procured for the reception of the healthy; and, when the medical officer of health recommends that the sick person shall not be removed, but that the healthy shall be removed from the same room in which the sick person is lying, the vestry or board shall cause the other inmates of such room to be removed to some convenient place of reception.

12. The vestry or board shall, in dwellings where cholera or diarrhœa exists, cause proper disinfectants to be used in sufficient quantities for the purpose of disinfecting the discharges from the sick, and the bedding, clothing, and other things thereby infected, and the utensils and privies in which such discharges may have been received.

13. The vestry or board shall cause every article of clothing, bedding, or furniture which shall have been infected with any such discharge,

and which they shall find incapable of being speedily disinfected, to be forthwith destroyed, the vestry or board within a reasonable time replacing all such articles, or paying the reasonable value to the owner.

14. If it be shown to the vestry or board that any drinking-water used in their parish or district is polluted, they shall take measures, with as much expedition as possible, for procuring wholesome water to be supplied in its stead, so far as the case requires, to the inmates of the houses in their parish or district, and for preventing, as far as possible, the further use of the polluted water. And every vestry or board owning or having possession of any waterworks for the supply of water shall cause the reservoirs, cisterns, pipes, pumps, and other apparatus belonging thereto, to be carefully examined, cleansed and purified, and other necessary measures to be taken, so that the water may be supplied without impurity.

15. The vestry or board shall make due arrangements with undertakers, and with the proper authorities of the churchyards, burial-grounds, and cemeteries of their parish or district, so that coffins may be ready to be supplied immediately on demand, and interments speedily take place in the cases of deaths arising from

cholera or diarrhœa; and the vestry or board shall, when informed of any such death, cause the corpse to be buried with the earliest possible despatch.

16. Where any death shall occur from cholera or choleraic diarrhœa, no collection of persons shall assemble in the room where the corpse is, and no "waking" of the dead shall be allowed.

17. The vestry or board shall cause the immediate removal, from any room which living persons inhabit, of the corpse of every person dying from cholera or choleraic diarrhœa, until the time of its interment, and shall cause such means to be adopted for preventing the spread of infection from the corpse as their medical officer of health shall recommend.

18. If the vestry or board shall be informed that cholera or choleraic diarrhœa exists, or within three days previously has existed, in any ship or vessel which may be lying within their parish or district, they shall cause the same to be forthwith visited, inspected, and otherwise dealt with, according to the circumstances of the case, in like manner as if it were an inhabited house on shore, and shall give all such medical and other directions in reference to the persons in such vessel or ship, as shall be requisite for preventing the spread of the disease, and for the

disinfection or disposal of any things which may be infected or may have been exposed to infection, subject always to the provisions of any Order of Council issued under the Quarantine Laws for the time being in force in such parish or district.

These directions embrace almost all that is possible to be done by a community anticipating an invasion of cholera.

CHAPTER VIII.

WHAT TO DO WHEN CHOLERA BREAKS OUT.

SUPPOSING all precautions to fail, and a case or cases of cholera occur in a house—what is to be done? Now, we need not say that a medical man should be sent for at once, and that to him should be entrusted the management of all matters relating to the sick person and the preservation of the family from its further spread. But, as in all cases much precious time may be lost in waiting for the medical man, and persons may be placed in situations where a medical man cannot be had, we shall here say a few words with regard to action where cholera breaks out.

In the first place, then, we would say that when cholera is about, every case of ordinary diarrhœa, or looseness of the bowels, should be treated as a case of cholera. All cholera is attended with a premonitory diarrhœa, which in that stage is not distinguishable from an ordinary purging. Whenever, therefore, purging commences in an individual he should regard himself as sick. A

such persons should, if possible, forego their usual occupations, and keep in bed. They should be covered up warm, and some medicine containing a small quantity of OPIUM should be given them at once. This dose should be repeated after every liquid evacuation. It would be well for persons to keep in the house a diarrhœa mixture. The following is a good one:—

Laudanum	5 drops.
Compound Tincture of Catechu .	30 drops.
Cajuput Oil	1 drop.
Chalk Mixture	½ an ounce.

If the mixture cannot be easily obtained, five drops of laudanum in half a wineglassful of peppermint water or weak brandy-and-water should be substituted.

It is unnecessary to multiply prescriptions for popular use; but should any one possess any of the preparations of opium of the British pharmacopœia, they should remember that about the third of a grain of opium may be given after every liquid evacuation. The dose should be less for children. Half the dose for an adult should be given to children under ten years of age, and from a drop to two drops of laudanum for children under five years of age. It should, however, be recollected that domestic treatment is always

hazardous, and nothing can substitute the eye of the experienced medical practitioner.

With regard to diet, it should consist mainly of slops; of beef-tea, broth, gruel, or rice. Caution should be used with regard to the administration of stimulants. Whilst weak brandy-and-water may be of great service, saccharine wines and beers, by producing acidity on the stomach, may do great harm. When good brandy cannot be obtained, the best substitute is Scotch or Irish whisky.

If, unfortunately, no medical aid should be at hand and the stools become colourless and watery, assuming the character known by the name of "rice-water," and vomiting should increase, and coldness and blueness come on, the opium should be discontinued and ardent spirits avoided. The patient should be allowed to drink cold water freely, and should be abundantly supplied with fresh air. He should lie in bed and warm applications be made to the feet and legs, and a mustard poultice or a pledget of linen dipped in turpentine should be applied to the stomach. The parts affected with cramps should be rubbed with the warm hand. It is efficient nursing, and not medicine, that does most good in this stage.

Thus much with regard to the treatment of

the patient, we now come to the question of what is to be done outside the patient, and one of the first things to be attended to here is the prevention of the spread of the cholera poison. Everything that the patient has worn, his night-dress and the sheets on which he lies, and the bedding and bed-furniture should be looked upon as capable of spreading the disease, and should be disinfected or destroyed. The safer way is, undoubtedly, to destroy by fire all soiled linen and clothes. Other things should be immediately disinfected and then plunged in boiling water. All that passes from the sick should be looked upon as highly poisonous, and should first be disinfected and then got rid of at once. Every sink, and vessel, and cloth, or article of bedding or clothing that have touched either the vomit or the stools should be disinfected. The closets or drains into which they are thrown should be constantly treated with some form or other of the various commonly used disinfectants.

Those who die of cholera should as speedily as possible be placed in their coffins and buried. At the bottom of the coffin should be placed a layer three or four inches deep of charcoal. The body should be sprinkled with a solution of some permanganate, and a layer of charcoal *should* be put on the top of the body and the lid *screwed down* immediately.

CHAPTER IX.

ON DISINFECTANTS.

Our essay would be incomplete without a few words on the nature of those substances which have been so often recommended under the name of "Disinfectants." Deodoriser is another term applied to the same set of substances. They are undoubtedly useful auxiliaries. When contagious diseases however break out, it should always be recollected that they are no substitutes for cleanliness and ventilation. In fact, if no other precautions are employed, they may be worse than useless as leading to a confidence which the experience of their employment does not justify. It is not always when bad smells are removed by their agency that the poison of disease has been destroyed.

Disinfectants act in two ways;—first, by preventing the diffusion of poisons; and secondly, by destroying these poisons. Thus we find that extreme cold and extreme heat act upon animal poisons in these ways. Extreme cold prevents

poisons from being diffused and oxidized, whilst extreme heat destroys the chemical structure of the poison, and assists the action of oxygen. It is in this way we may account for the arrest of contagious diseases by the existence of extremes of atmospheric heat and cold.

The agents which act in the same way as cold are carbolic acid, kreasote, camphor, musk, alcohol, and other chemical agents. Of these only one is generally available for disinfecting purposes during cholera, and that is *carbolic acid*. This acid can be obtained pure and added to water; one part of acid to fifty of water may be applied as a solution for washing out drains and sinks, and yards, and a stronger solution may be used for mixing with cholera evacuations, and rinsing out chamber-utensils and other vessels infected with the evacuations.

Carbolic acid is also used in conjunction with lime and other agents, and may thus be used in a solid form. This acid forms the principal in McDougall's disinfecting powder, which is sold in sealed bottles with holes over the mouth, so as to admit the powder being dusted about in the same manner as pepper from a pepper-castor.

There is another acid having the same properties as carbolic acid, called acrylic acid.

This acid, combined with lime and other agents, is sold under the name of Calvert's Carbolic Acid Powder, in tin cases with holes at the top. This powder is sold wholesale at 15s. per cwt., or 6*l*. a ton.

These powders may be used advantageously for disinfecting large spaces, such as drains and sewers, where men are working at removing the soil from cesspools and drains, coach-houses, stables, &c.

Those agents which act by destroying animal and vegetable poisons are extreme heat, chlorine, ozone, permanganates of potash or soda, nitrous acid, sulphurous acid, iodine, bromine. Of these, the most available are heat, chlorine and ozone. It has been shown by experiment that a temperature equal to that of boiling water will destroy the poison of certain infectious diseases. As boiling water is easily procured in most households, a sufficient quantity should be ready, in which to plunge all garments and linen which have been soiled by the person sick of cholera. This can be done after they have been removed from the room of the patient, when they have been heated with some other disinfectant.

Chlorine is perhaps the most active of all disinfectants. The best way to apply it for dis-

infecting the air, is to use it as gas. The most ready way of manufacturing it is to take

Common salt, 4 parts,
Peroxide of manganese, 1 part,
Sulphuric acid (oil of vitriol) and water,
of each 2 parts.

Mix the salt and peroxide, and put them into a basin, and then put in the oil of vitriol, and afterwards the water. This may be placed in some convenient part of the room to be disinfected, care being taken not to mix too large a quantity for the room, and to avoid directly breathing the pure chlorine.

When persons have not sufficient confidence in their chemistry to use the above, "chloride of lime," as it is called, may be employed, which, when placed in water slowly evolves chlorine, and is a very manageable substance.

Ozone is an active form of oxygen gas. Oxygen is nature's great disinfectant. The world is kept from putridity and death by oxygen. At the same time ozone is not easily manufactured pure for disinfecting purposes, but in permanganic acid we have a large quantity of ozone, which is readily given off when it comes in contact with organic matters. This acid *forms permanganates* which are easily manufactured, and a solution of them is now sold in

the shops under the name of Condy's disinfecting fluid. The permanganates speedily give out their ozone and become a ready means of disinfection. Condy's fluid is well adapted for disinfecting liquids of all kinds, also for floors, furniture, and clothes; but the ozone is not given off from this preparation into the air. Hence it is useless to employ it for diffusing ozone.

We have before alluded to water containing oxygen, and it is in this way that water itself may become a disinfectant. It can, however, only be where water is free from organic matter that it acts thus. It is where water is charged with organic matter that it conveys the poison of cholera; and, unfortunately, this is often the case with our rivers and wells.

There are many other disinfectants or deodorisers, but those we have mentioned above are the best known and most readily accessible. The following demand, however, attention, and may be used when found convenient.*

Chloride of zinc is the basis of "Burnett's Fluid." It has the power of destroying ammoniacal compounds and organic matter, and thus acts as a disinfectant.

Perchloride of iron has the power of destroy-

* Appendix B.

ing sulphuretted hydrogen, and thus of deodorising the decaying compounds to which it is added.

Iodine is an expensive deodorising agent, but is said to be very efficacious. It decomposes sulphuretted hydrogen and arrests putrefaction. It is best used by exposing pure iodine in a room upon a hot plate.

Nitrous acid is a powerful deodoriser and disinfectant. It can easily be produced by putting a piece of copper into nitric acid, when red fumes are produced which are nitrous acid.

Sulphurous acid, which is evolved when sulphur is burned in the open air, has been strongly recommended as a disinfectant, but its fumes are very stifling and oppressive.

We have now finished the task we set ourselves on commencing this little work. Our object has been to indicate the nature of the terrible disease which has now for the fourth time visited our country. We feel convinced that when once the causes and means of preventing this disease are fully understood by the great bulk of the community it will be disarmed of its terrors and deprived of its power of destroying life. It is one of those visitations of Providence that result from the ignorant breaking

of those laws by which the lives of human beings are governed. At this moment we have to deal with its awful presence, but we may hope by intelligent action, and Christian courage, that its stay amongst us may be of brief duration. Our future freedom from its dreaded visitations must be looked for in the improved health and intelligence of our poorer classes. This object can only be obtained by the education of the great mass of the people. We need in our universities, our high schools and middle-class schools, our Sunday-schools and ragged schools, a larger teaching of those laws of life on which the health of the people depends. "My people perish, and there is none to consider," was the divine complaint of old, and surely it is most appropriate now! We are surrounded by the sources of disease and death. "Surely the curse causeless will not come;" and if we have in these remarks shown that our present affliction has arisen from causes over which man holds almost supreme control, we ought to have done enough to awaken in every intelligent mind a sense of the duty of earnestly studying the nature of those causes the removal of which the Almighty Disposer of events has so evidently placed within our reach.

APPENDIX

A.

REMARKS ON THE "BLUE MIST" OBSERVED BY MR. GLAISHER.

By E. Ray Lankester, Esq., *of Christchurch, Oxford.*

It was suggested by Mr. Glaisher that it would be desirable to make an examination of the blue mist noticed by him, by means of the microscope, and accordingly the following means were used for obtaining any particles which might be present in the air in order to examine them :—1st. Slips of glass were cleaned and exposed under trees where the blue mist was observable. 2nd. A pane of window-glass was cleaned and exposed to the mist for ten days, at Hampstead; the translucent film which had collected on it was removed with pure boiled water and a clean brush. 3rd. A pair of bellows, carefully cleaned, *was made to* blow the "mist" for half an hour

through a small bottle of perfectly pure water. The sediment from the water and the slips of glass were at once examined; besides a few insect-scales and dust grains—in all, three cases—a great abundance of minute granular aggregations was seen, the largest of the granules not exceeding 1-6000th of an inch in diameter. The granules were highly refractive, and presented all the characters of fungoid growths, being similar to the spores of the yeast plant and other moulds. The abundance of these spherical granules, sometimes grouped in chains, was very noticeable.

In a paper read by Mr. Jabez Hogg to the Microscopical Society of London, I find that during the cholera visitation of 1854, the Rev. Lord Godolphin Osborne obtained these fungus spores from the neighbourhood of cesspools, gullyholes, &c., and termed them "*aërozoa*." Mr. Hogg has himself observed them ever since that time in all places and at all seasons, and remarks that there is no doubt that at the end of hot weather, and in the autumn time, they are most abundant.

There is no *evidence* whatever that the fungus spores noticed in the blue mist are peculiar in their nature, or connected in any way with cholera. The only thing remarkable about

them is their very great abundance, which though by no means so great as to lead to the belief that they actually compose the mist, may perhaps account for its density and greyish or light-blue colour.

It may be mentioned that "blights" or dense mists, carrying innumerable fungus spores, are not uncommon local occurrences, resulting in the disease and destruction of many crops.

B.

The following directions for the use of disinfectants, and printed on gummed paper, for attaching to bottles, &c., have been drawn up by Mr. Johnstone, of the Saint James's Dispensary :—

POISON.

CHLORIDE OF LIME.

Four or Five handfuls to be thrown down any place that smells badly.

POISON.

CHLORIDE OF SODA.

Half-a-pint to be added to each gallon of hot or cold water used in washing blankets, sheets or clothes of persons ill with Diarrhœa or Cholera.

POISON.

CARBOLIC ACID.

Half-a-pint to be added to each pail of hot or cold water used in scrubbing floors of houses where there is Diarrhœa or Cholera.

POISON.

CONDY'S DISINFECTING FLUID.

About a Table-spoonful to be added to each quart of water used for washing basins, bed-pans, &c., or the hands of persons nursing people ill with Diarrhœa or Cholera.

THE END.

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